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Integrating, substituting value of b , and reducing,

$$V_2 = \frac{(d-r)[3a^2r^2 - (d-r)^2(2ah-h^2)]}{3r\sqrt{(2ah-h^2)}} \left[\pi - 2 \sin^{-1} \left(\frac{r(a-h)}{\sqrt{[a^2r^2 - (d-r)^2(2ah-h^2)]}} \right) \right] \\ + \frac{\pi r^2 h(3a-h)}{3(2a-h)} - \frac{4}{3}(d-r(a-h))\sqrt{(2dr-d^2)} \\ + \frac{4a^3r^2}{3(2ah-h^2)} \tan^{-1} \left(\frac{(a-h)(d-r)}{a\sqrt{(2rd-d^2)}} \right) - \frac{2r^2(a-h)}{3(2ah-h^2)} \frac{(2a^2+2ah-h^2)}{\sin^{-1} \left(\frac{d-r}{r} \right)}.$$

$$\text{If } d=2r, V_2 = \frac{2\pi r^2 h(3a-h)}{3(2a-h)}.$$

$$\text{If } d=2r, a=h, V_2 = \frac{4}{3}\pi r^2 h. \quad \text{Total volume} = V + V_2.$$

Also solved by G. W. GREENWOOD.

162. Proposed by J. E. SANDERS, Hackney, O.

Solve the differential equations

$$(a) \ x \frac{dy}{dx} - y = x\sqrt{(x^2 + y^2)}, \quad (b) \ \cos x \frac{dy}{dx} + y = 1 - \sin x.$$

Solution by G. B. M. ZERE, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.; E. L. SHERWOOD, Professor of Mathematics, Shady Side Academy, Pittsburg, Pa.; M. E. GRABER, Graduate Student, Heidelberg University, Tiffin, O.; and the PROPOSER.

$$(a) \ xdy - ydx = x[x^2 + y^2]dx. \quad \text{Let } y=vx. \quad \therefore dy = vdx + xdv.$$

$$\therefore dx = \frac{dv}{v[1+v^2]}. \quad \therefore x+A = \log\{v + v[1+v^2]\}.$$

$$\therefore x+A = \log\left(\frac{y + v[x^2 + y^2]}{x}\right).$$

$$(b) \ \cos x dy + ydx = [1 - \sin x]dx. \quad \text{Let } y=v[1 - \sin x].$$

$$\therefore dy = [1 - \sin x]dv - v\cos x dx. \quad \therefore dx = \cos x dv - v\sin x dx = d[v\cos x].$$

$$\therefore x+A = v\cos x = \frac{y\cos x}{1 - \sin x}. \quad \therefore y\cos x = [x+A][1 - \sin x].$$

Solved in the same way by HOMER R. HIGLEY, LON C. WALKER, and J. SCHEFFER.